REMARKS

This application has been amended. Specifically, claim 4 has been amended to define the upper limit of the distribution degree of the modified cycloolefin copolymer in the base polymer to be 0.04 rather than 0.1. Support for this amendment can be found in Examples 1 and 2 on pages 37 and 38 of the application as filed. In addition, the examples in the application previously labeled as Example 3 and Example 4 have now been reclassified as Comparative Example 1 and Comparative Example 2, respectively, in view of the current scope of the claims. No new matter has been added. Claims 4-5, 7-9, 21, 23, 25-26 and 28-29 are currently pending, of which claim 4 is in independent form.

Claims 4-5, 7-9, 21, 23, 25-26 and 28-29 stand rejected under 35 U.S.C. §103(a) for obviousness over U.S. Patent No. 6,472,082 to Kodemura. For the following reasons, Applicants respectfully submit that the pending claims are not obvious in view of Kodemura and thus the outstanding rejections should be reconsidered and withdrawn.

Claim 4 is directed to a process for producing modified cycloolefin copolymers. The process includes the steps of adding a modifier compound and an organic solvent to a base polymer in an inactive atmosphere while stirring to produce a solution and, while heating the solution, adding dropwise 7 to 50 parts by weight of an organic-solvent solution containing 2 to 25 parts by weight of a hydrogen-abstracting peroxide compound dissolved therein. The peroxide compound is added in an amount such that the ratio (in terms of the number of moles of radicals) of the peroxide compound to a polymerizable unsaturated group in the modifier compound is 0.7-2.5/1. The copolymer is then thermally aged and cooled to room temperature. The process is conducted so as to achieve a distribution degree of the modified cycloolefin copolymer in the base polymer in the range of 0.01 to 0.04 expressed in terms of the distribution correlation coefficient (DR) defined by the equation: $(DR) = [(RI) - (UV)]^2$.

Applicants have found that, through the claimed process, the main-chain cylcoolefin chains are converted into radicals without ring opening of the cycloolefin chains, and an "electron accepting/electron donating" relationship is created which allows the conventionally-difficult incorporation of the modifier

compound into to the cycloolefin main chains to be achieved at a higher level than is achieved by previously-known processes. Because according to the claimed process the addition reaction is possible without ring opening of the main-chain cycloolefin chain skeletons, the inventive method can provide modified cycloolefin copolymers in which the functional groups are added uniformly in the cycloolefin copolymer without producing the heterogeneous structures commonly attributed to the ring-opening reactions utilized in conventional addition processes.

In the claimed method the peroxide compound is added in an amount such that the ratio (in terms of the number of moles of radicals) of the peroxide compound to a polymerizable unsaturated group in the modifier compound is between 0.7/1 and 2.5/1. By way of further explanation, a detailed calculation of this ratio for Examples 1 and 2 and Comparative Examples 1 and 2 (formerly Examples 3 and 4) follows:

Example 1:

- Peroxide (10 parts by weight): benzoyl peroxide (mw=242.2, two radicals);
- Modifier (10 parts by weight) maleic anhydride (mw=98.1);
- Ratio = (2x10/242.2) / (10/98.1) = 0.81.

Example 2:

- Peroxide (25 parts by weight): benzoyl peroxide (mw=242.2, two radicals);
- Modifier (20 parts by weight) maleic anhydride (mw=98.1);
- Ratio = (2x25/242.2) / (20/98.1) = 1.01.

Comparative Example 1 (formerly Example 3):

- Peroxide (2 parts by weight): benzoyl peroxide (mw=242.2, two radicals);
- Modifier (15 parts by weight) 2-methylallyl glycidyl ether (mw=114.2);
- Ratio = (2x2/242.2) / (15/114.2) = 0.13.

Comparative Example 2 (formerly Example 4):

- Peroxide (2 parts by weight): benzoyl peroxide (mw=242.2, two radicals);
- Modifier (20 parts by weight) 4-chloro-1-butanol (mw=108.6);
- Ratio = (2x2/242.2) / (20/108.6) = 0.09.

A comparison of Examples 1 and 2 with the Comparative Examples, summarized in Table 1 and described on pages 41 and 42 of the specification as filed, shows that the claimed method, where the amount of peroxide relative to the amount of modifier compound is controlled to within the prescribed ratio, provides for the addition of functional groups to the base polymer molecules more uniformly than is found in conventional modified cycloolefin copolymers, as expressed in terms of the distribution correlation coefficient (DR) of between 0.01 and 0.04. This allows the modified cycloolefin copolymers prepared according to the claimed method to exhibit improved solubility in various organic solvents, including toluene, propylene glycol monomethylether acetate (PGA), and methyl ethyl ketone (MEK). For instance, Examples 1 and 2 each show complete dissolution in all of the mentioned solvents while the Comparative Examples do not.

Kodemura is directed to a modified thermoplastic norbornene polymer that is prepared by grafting an unsaturated epoxy or carboxylic compound onto a norbornene polymer. Kodemura defines the rate of graft modification as the ratio of the total number of moles of the modifying group compared with the total number of monomer units in the polymer. Kodemura suggests a rate of graft modification of between 10 and 100%. Kodemura also mentions that an organic peroxide can be used as the radical initiator for carrying out the graft copolymerization.

Kodemura does not suggest that the amount of organic peroxide initiator added is dependent on the amount of polymerizable unsaturated groups of the modifier compound that are present. Instead, Kodemura makes the broad statement that the radical initiator is "generally within a range of 0.001 to 10 parts by weight, preferably 0.01 to 5 parts by weight, more preferably 0.1 to 2.5 parts by weight per 100 parts by weight of the unmodified thermoplastic norbornene polymer."

(Kodemura, col. 15, lines 41-46). However, this passage does not suggest or provide a relationship between a peroxide initiator and the modifier compound, but only between an initiator and the unmodified polymer. Moreover, the specific examples of Kodemura suggest that the ratio of the peroxide to the modifier compound is far below the range recited in the claims, and more akin to the ratio present in the Comparative Examples of the instant applications. For instance, Example 3 of Kodemura includes 3 parts by weight of dicumyl peroxide (mw=270.37, 2 radicals) and 30 parts by weight maleic anhydride (mw=98.1). The ratio (in terms of the number of moles of radicals) of the peroxide compound to a polymerizable unsaturated group in the modifier compound, using the same calculation as above, is then: $(2 \times 3/270.37) / (30/98.1) = 0.3$. This is not within the ratio range defined in the claims. It is noted that the Office Action asserts that a number of the examples in Kodemura closely correspond to those disclosed in Examples 3 and 4 of the instant specification and thus anticipate the claimed ratios. However, as described above, Examples 3 and 4 are not considered illustrative examples and the ratio of components disclosed therein, like the examples of Kodemura, do not fall within the claimed range.

The Office Action is also incorrect where it states one skilled in the art would find it obvious to modify the peroxide:modifier ratio to arrive at the claimed method. Rather, Kodemura discloses compositions having peroxide:modifier ratios that are far from those recited in the claims and specifically provided in the examples. Moreover, Kodemura fails to provide any justification for varying the relative amounts of peroxide and modifier considerably away from the values in the illustrative examples to align with the claimed range. Doing so would require one to essentially disregard the teachings and evidence provided in the working examples of Kodemura and instead explore entirely distinct ranges of the peroxide and modifier amounts.
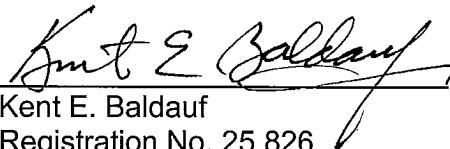
Applicants further disagree with the Office Action to the extent it implies that the claimed peroxide:modifer ratio used in the method has no significant impact on the final product. Applicants have presented, by way of illustrative and comparative examples, evidence showing that the solubility of the resulting compounds in various solvents is improved by employing the claimed

peroxide:modifier ratio. Since recognition or appreciation of this relationship is admittedly absent from Kodemura, and the Office Action has failed to provide any other evidence explanation as to why it would be within the knowledge of the skilled artisan, it can be said that these results are unexpected in view of the cited art.

Additionally, while Kodemura discusses that a high rate of graft polymerization is preferred, it does not discuss the uniformity of the modification of the base norbornene polymer, which is one feature of Applicants' method as expressed in terms of the distribution correlation coefficient. The Office Action asserts that the distribution correlation coefficient value recited in the claims is inherently present in the modified norbornene polymer of Kodemura. However, this conclusion is based on the assumption that the process in Kodemura, in terms of amounts and types of reactants used, is substantially analogous to the claimed process. As explained above, this is not a correct assumption based on the actual disclosure of Kodemura. Notably, the Kodemura process does not control the peroxide:modifier ratio to within the claimed range. Thus, it is entirely speculative to assume the distribution degree of the modified norbornene polymer in Kodemura falls within the distribution correlation coefficient values recited in the claim.

For the foregoing reasons, Applicants submit that the pending claims are patentable over the cited documents of record and are in condition for allowance. Accordingly, reconsideration of the outstanding rejections and allowance of pending claims 4-5, 7-9, 21, 23, 25-26 and 28-29 is respectfully requested.

Respectfully submitted,

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